

TEXAS CHILDREN'S HOSPITAL

EVIDENCE-BASED OUTCOMES CENTER

Primary Spontaneous Pneumothorax (PSP)

Evidence-Based Guideline

Definition: Pneumothorax refers to air in the pleural cavity (i.e., interspersed between the lung and the chest wall). ^(1,2)
Primary spontaneous pneumothorax (PSP) occurs in otherwise healthy patients; secondary pneumothorax is associated with underlying lung disease. ⁽¹⁻⁴⁾

Etiology: Anatomical abnormalities have been demonstrated, even in the absence of overt underlying lung disease. ⁽²⁾
Smoking has been implicated in the etiology of PSP.

Inclusion Criteria

- Initial or recurrent spontaneous pneumothorax in otherwise healthy patients

Exclusion Criteria

- Underlying chronic lung disease
- Explained pneumothorax (e.g., traumatic, iatrogenic, or resulting from birth)
- Pregnant women

Differential Diagnosis

Tension pneumothorax
Secondary spontaneous pneumothorax
Traumatic pneumothorax

Diagnostic Evaluation ^(2,4)

History: Assess for

- Abrupt onset when at rest or with minimal exertion
- Exclusion of explained pneumothorax

Physical Examination

- Chest pain
- Dyspnea
- Asymmetric lung expansion
- Diminished breath sounds
- Hyperresonance on percussion
- Sweating, tachypnea, tachycardia

Critical Points of Evidence*

Evidence Supports

- Utilize inspiratory chest x-ray to detect and diagnose primary spontaneous pneumothorax. ⁽¹⁻¹⁶⁾ – Strong recommendation, moderate quality evidence
- Obtain a CT for recurrent (>1) pneumothorax or suspected underlying lung pathology, or for surgical planning if persistent air leak >4 days. ⁽⁵⁻¹⁶⁾ – Strong recommendation, very low quality evidence
- Observe patients with a small pneumothorax and administer oxygen. Obtain a chest x-ray at 4-6 hours and if no progression of size, remove oxygen and consider discharging the patient, if the patient no longer requires oxygen and is on room air. If the pneumothorax has increased in size at the time of the subsequent chest x-ray, insert a pleural (pigtail) catheter or chest tube. ^(1-4,10,13,15,17-30) – Strong recommendation, very low quality evidence
- Insert a pleural (pigtail) catheter or chest tube for patients with a large pneumothorax. ^(1,3,10,13,14,17-30) – Strong recommendation, very low quality evidence
- Perform surgical intervention for patients with a recurrent pneumothorax or persistent air leak >4 days. ^(1-3,5,10,13,14,17-30) – Strong recommendation, very low quality evidence
- Consider surgical intervention for patients with blebs/bullae on CT, if obtained. ^(10,13,14,17-30) – Weak recommendation, very low quality evidence
- Consider bilateral surgical intervention if contralateral blebs/bullae are detected. ^(10,13,14,17-30) – Weak recommendation, very low quality evidence
- Insert a pleural (pigtail) catheter vs. a chest tube to minimize patient discomfort. ^(1,2,26,32-39) – Strong recommendation, very low quality evidence
- Provide supervision for learners inserting a chest tube or pleural (pigtail) catheter. ^(33,40-42) – Strong recommendation, very low quality evidence

Evidence Lacking/Inconclusive

- Manage each pneumothorax independently in the case of bilateral pneumothoraces. – Consensus recommendation
- Position the patient in a supine position when inserting a pleural (pigtail) catheter/chest tube. – Consensus recommendation
- Utilize chest x-ray to confirm adequate placement of a pleural (pigtail) catheter/chest tube. ⁽³³⁾ – Consensus recommendation
- Administer oxygen via non-rebreather mask on initial diagnosis. If no further intervention is needed, transition to nasal cannula. – Consensus recommendation
- Remove the pleural (pigtail) catheter/chest tube in a staged manner once a chest x-ray demonstrates complete resolution and there is no clinical evidence of air leak. Any suction should be discontinued. ^(1,3,33) – Consensus recommendation

*NOTE: The references cited represent the entire body of evidence reviewed to make each recommendation.

Condition-Specific Elements of Clinical Management**Admission Criteria**

- Significant chest pain
- Oxygen requirement
- Respiratory distress (tachypnea, dyspnea, retractions)
- Need for chest tube placement

Discharge Criteria

- Afebrile
- Oxygen saturations >90% on room air
- Resolution of chest pain and/or respiratory distress
- Stable or resolving small pneumothorax by chest X-ray
- Removal of chest tube with normal/stable chest X-ray

Consults/Referrals

Consult surgery after radiologic confirmation of PSP.

Follow-Up Care

Outpatient visit with Surgery within 3 weeks

Measures**Process**

- CXR vs. CT as initial diagnostic study
- Placement of chest tube by IR vs. surgery
- Chest tube requirement for patients who were initially only observed

Outcome

- "Immediate" recurrence after chest tube removal
- Length of stay
- Readmission for chest pain or dyspnea
- Ipsilateral recurrence within 30 days

TCH Evidence-Based Outcomes Center

Diagnosis and Management of Primary Spontaneous Pneumothorax

Inclusion Criteria:

Initial or recurrent spontaneous pneumothorax in otherwise healthy patients

Exclusion Criteria:

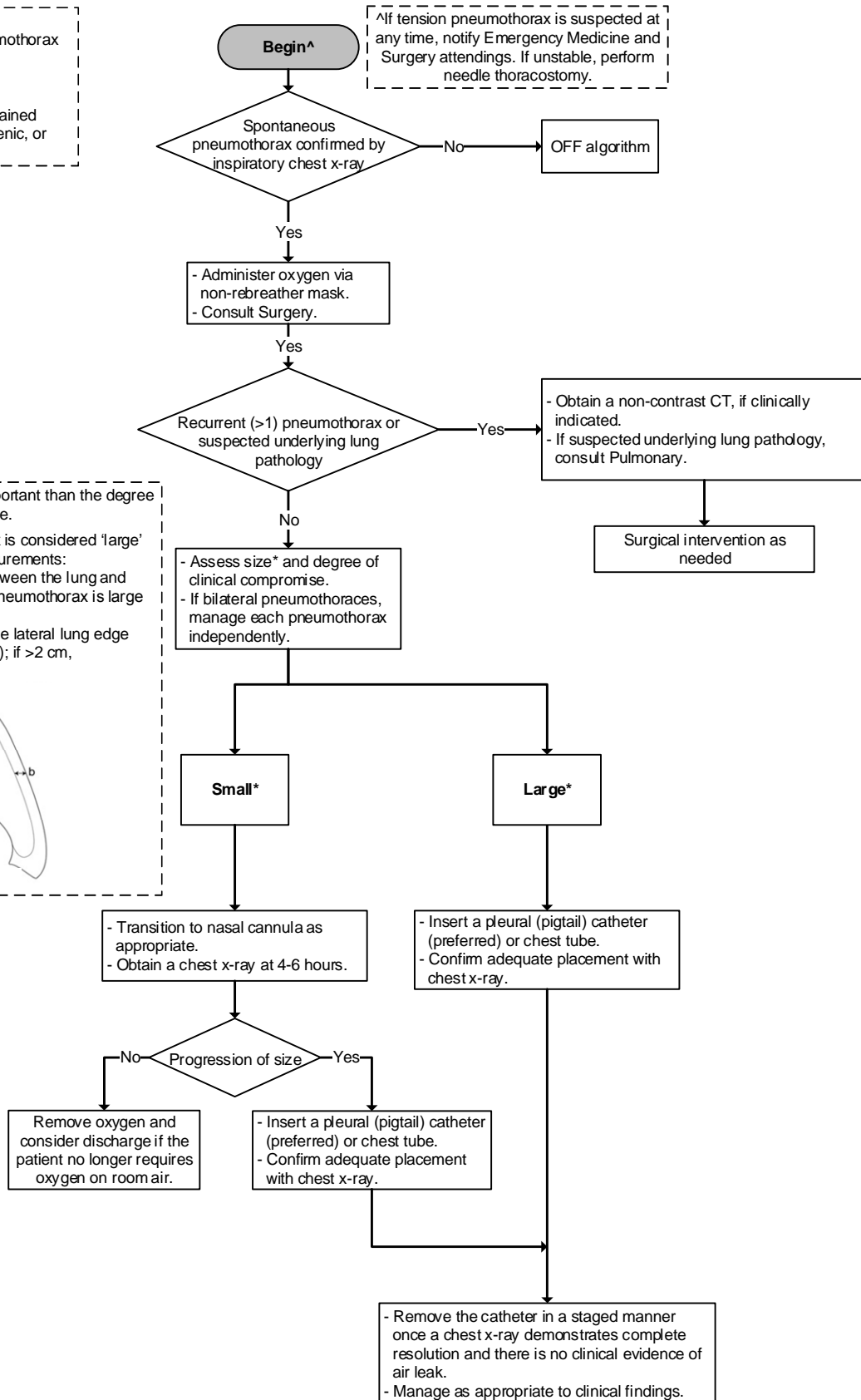
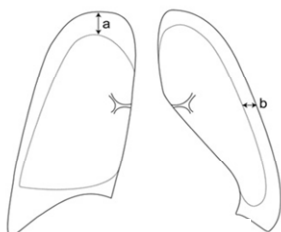
Underlying chronic lung disease, explained pneumothorax (e.g., traumatic, iatrogenic, or resulting from birth)

[^]If tension pneumothorax is suspected at any time, notify Emergency Medicine and Surgery attendings. If unstable, perform needle thoracostomy.

*The size of the pneumothorax is less important than the degree of clinical compromise.

For children >12 years, a pneumothorax is considered 'large' based on the following measurements:

- Measurement of the vertical distance between the lung and thoracic cage at the apex (a); if ≥ 3 cm, pneumothorax is large
- OR
- Measurement of the distance between the lateral lung edge and chest wall at the level of the hilum (b); if >2 cm, pneumothorax is large



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Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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No relevant financial or intellectual conflicts to report.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
 - PICO questions established
 - Evidence search confirmed with content experts
2. Review of Existing External Guidelines
 - Belgian Society of Pneumology Management of Spontaneous Pneumothorax, British Thoracic Society Management of Spontaneous Pneumothorax, British Thoracic Society Pleural Procedures and Thoracic Ultrasound, British Thoracic Society Management of Pleural Infection in Children, American College of Chest Physicians Management of Spontaneous Pneumothorax, The Royal Children's Hospital Melbourne Primary Spontaneous Pneumothorax
3. Literature Review of Relevant Evidence
 - Searched: Cochrane, PubMed, Google
4. Critically Analyze the Evidence
 - 1 randomized controlled trial and 39 nonrandomized studies
5. Summarize the Evidence
 - Materials used in the development of the guideline, evidence summary, and order sets are maintained in primary spontaneous pneumothorax evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of

Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions.

"Evidence Supports" provides evidence to support an intervention

"Evidence Against" provides evidence against an intervention.

"Evidence Lacking/Inconclusive" indicates there is insufficient evidence to support or refute an intervention and no conclusion can be drawn *from the evidence*.

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the diagnosis and management of primary spontaneous pneumothorax in children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care, and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient family, to make the ultimate judgment regarding care.

Version History

Date	Comments
Apr 2017	Originally completed